Installation Guide

RMAS-120-81 and -91 UHF Radio Extensions

Introduction

The RMAS-120-81 and -91 adds a UHF Radio Link to the RMAS-120 Remote Monitor and Alarm System. The UHF Radio Link provides an alternative transmission channel for the RF Repeater Alarm data that is otherwise carried by added modulation to the repeated microwave carriers.

The -81 UHF Radio operates in the 902 ~ 928 MHz band while the -91 UHF Radio operates in the 2400 MHz band. Both use frequency hopping spread spectrum coding. These are license free bands under US-FCC Part 15.247 rules and Canadian ISC document RSS-210. The duplex radios are GE MDS NETioB-900 and NETioB-2400 with Expansion Modules.

The RMAS-120-01 Alarm Transmitter unit's local alarm points are routed to the MDS radio link equipment. Eight (8) alarm points are transported in this RMAS-120-81 configuration. Other configurations can transport 14 or 20 alarm points. Contact PESi for availability.

Additionally, the battery temperature voltage is transported on an analog voltage to instrumentation current loop channel. Alarms are sent from the RF Repeater site to the RMAS-120-81, -91 UHF Telemetry Receiver located at the associated microwave radio terminal end.

The duplex radio link is configured with one control channel from the Telemetry Receiver to the RF Repeater site. This control channel provides a closure at the repeater site and can be used as required. Examples are: GenSet start and equipment shutdown.

The radio link equipment is normally configured at the PESi factory for the particular field application. See the factory test data sheet for more details.

900 MHz version:

System Part Number:	900-0782-81
RMAS-120-01 PN:	090-0781-01
UHF Telemetry Tx PN:	090-0783-81
UHF Telemetry Rx PN:	090-0784-81

2400 MHz version

System Part Number:	900-0782-91
RMAS-120-01 PN:	090-0781-01
UHF Telemetry Tx PN:	090-0783-91
UHF Telemetry Rx PN:	090-0784-91

UHF Telemetry and RMAS Transmitter Assembly

The 090-0783-81, -91 UHF Telemetry Transmitter Assembly and 090-0781-01 RMAS-120 Alarm Transmitter Assembly are shown in Figure 1.
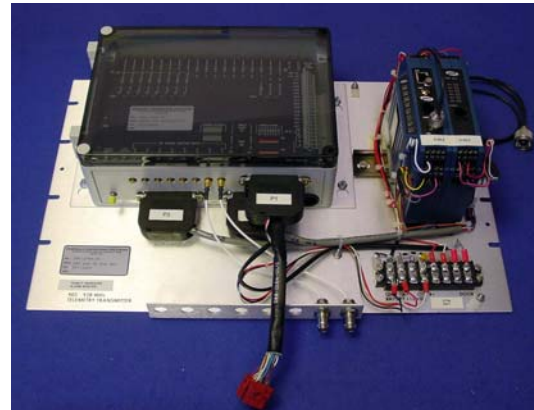

Figure 1, RMAS UHF Transmitter Assy

Installation Guide

Mounting

The UHF Transmitter Assembly mounts inside the repeater door or in a 19-inch rack below the RF Repeater. The unit is 8U high.

Figure 2, RMAS UHF Tx in RF Repeater

Antenna

A 902 ~ 928 MHz or 2400 MHz directional antenna should be installed on the tower or antenna support structure that also mounts the microwave antennas. Normally, the UHF path is parallel to one of the microwave paths and Line-of-Sight is expected.

Antenna feedline can be 3/8" or ½" Foam Filled Coax terminated in a Type-N(f) connector at the radio end.

The gain of the antenna and feedline combination may be limited by regulations. The 900 MHz maximum EIRP is +36 dBm by US-FCC regulations. With the transmitter set at low power, 100mW or +20 dBm, the antenna gain – feeder loss must not exceed 16 dBi. If the highest power setting is used, 1-Watt or +30 dBm, the net gain limit is 6dBi. The radios transmit power may be set in 1 dB increments from +20 to +30 dBm for 900 MHz and +20 to +27 dBm for 2400 MHz.

Lightning Arrestors are recommended.

Transmit Power

Recommend using the 100mW, +20 dBm lower power setting for LOS paths. The lower power setting also reduces the DC current load and is best for solar powered sites.

Peninsula's UHF antenna kits use 12 dBi gain antennas and 3/8-inch or ½-inch coax. At typical 50-Ft feedline plus the jumper at the alarm equipment has 2 dB of loss. In this case, the maximum output power setting is +26 dBm.

UHF Transmitter Settings

The GE MDS NETio radio has been factory set for the application. If changes are required, see the section *Admin Access to the GE MDS NETio* following or the GE MDS NETio manual for details, 05-4457A01, Rev D or later, PES PN 551-0790-01.
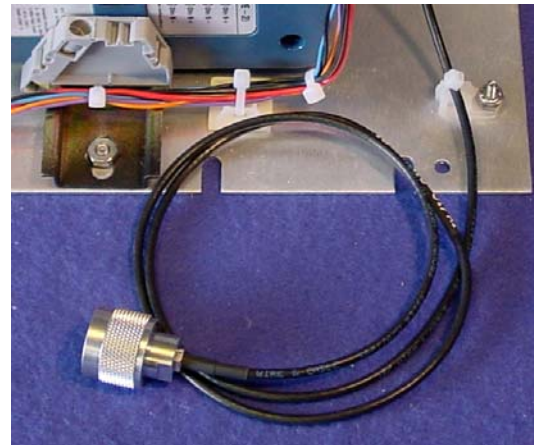

Figure 3, UHF Tx Antenna Cable

Installation Guide

Antenna Kit

If an antenna kit from PESi was supplied, install the included lightning arrestor at the bottom of the RF Repeater enclosure. Punch or drill a 5/8-inch diameter hole for the Type N(f) connector and mounting bracket. Locate the hole toward the left side as viewed from the front. Be sure the internal antenna cable jumper will reach the hole location. Follow the installation directions supplied with the lightning arrestor.

Figure 4, UHF Tx Lightning Arrestor, at bottom of RF Repeater enclosure

Connections

| UHF & RMAS Tx Assy	Connect to:
UHF Antenna Jumper, Type-N(m), Fig. 3	UHF Antenna feedline, Type-N(f) (Lightning Arrestor)
Door on Screw Terminal Block Wht/Blu/Blk Wht/Blk/Slt	Repeater Door Switch cable, (no polarity). Wht/Grn/Blk Wht/Yel/Blk
RF Power Monitor F1	F1 BNC coax cable
RF Power Monitor F2	F2 BNC coax cable
J1 Adapter Cable, 20 Pin	Repeater Alarm Cable, P1
Waveguide Pressure Sensor RMAS TX Internal TB-1 IN - 5 IN - 4	Waveguide Pressure Sensor Cable (no polarity) Green Blue
Temperature Sensor RMAS TX Internal TB-1 C – 3 B – 2 A – 1	Temperature Sensor Cable Yellow - C White - B Black - A
Caution! *Once battery is connected, the UHF Transmitter will begin transmitting.*	
Battery A+ 12 VDC or 8.5 VDC	DC Power Cable with 3-pin plug P1 is attached to the RMAS Tx TB-1 and connects to the RF Repeater Aux DC connector located on the repeater door. 12V repeaters = P6 24V repeaters = P7
Battery B+ 12 VDC or 8.5 VDC	
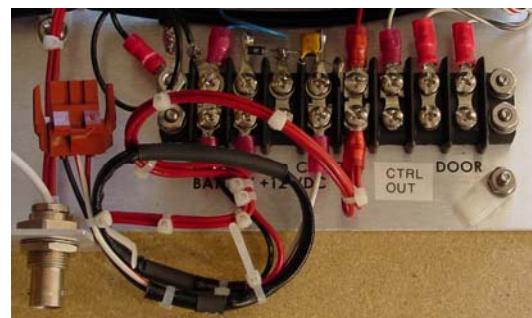
Figure 5, Screw Terminal Block TB-1, UHF Tx with P1 DC Power Cable

Note the PWR and LINK LEDs on the MDS Transmitter. Both should be <u>ON</u>.

Installation Guide

Turn on the RMAS-120 Alarm Transmitter and verify operation by pressing the LED Switch. All alarm LEDs should light briefly (lamp test) and then only the actual alarms will remain ON.

Confirm the RMAS-120 Alarm Transmitter OPTO COPLR jumper is set to ENB.

RMAS-120-81 UHF Telemetry Receiver

The 090-0784-81, -91 UHF Receiver Assembly is shown in Figure 6.

Figure 6, UHF Telemetry Receiver Assy

Mounting

The UHF Receiver Assembly mounts in a 19-inch rack. The unit is 2U high with a 5-inch front projection.

Antenna

A directional antenna should be installed on the tower or antenna support structure that also mounts the microwave antennas. Normally, the UHF path is parallel to one of the microwave paths and Line-of-Sight is expected.

Antenna feedline can be 3/8" or ½" Foam Filled Coax terminated in a Type-N(m) connector at the radio end.

The gain of the antenna and feedline combination may be limited by regulations. The maximum EIRP is +36 dBm. With the transmitter set at low power, 100mW or +20 dBm, the antenna gain – feeder loss must not exceed 16 dBi. If the high power setting is used, 1-Watt or +30 dBm, the net gain limit is 6 dBi.

Lightning Arrestor is recommended.

UHF Receiver Settings

The GE MDS NETio radio has been factory set for the application. If changes are required, see the section *Admin Access to the GE MDS NETio* following, or the GE MDS NETio manual for details, 05-4457A01, Rev D or later, PES PN 551-0790-01.

Figure 7, Rx MDS Modules

Connections

UHF Receiver Assy	Connect to:
UHF Antenna Port, Type-N(f)	UHF Antenna feedline, Type-N(m)
Caution! Once battery is connected, the UHF Receiver will begin operating. This unit includes a UHF transmitter.	
20-60 VDC IN, GND, +, - Isolated Input Fuse at 1 Amp	For Negative Battery, jumper the (+) terminal to GND and connect to Rack Ground. Connect fused (-) Battery to the (-) terminal.

Figure 8, UHF Receiver, Rear
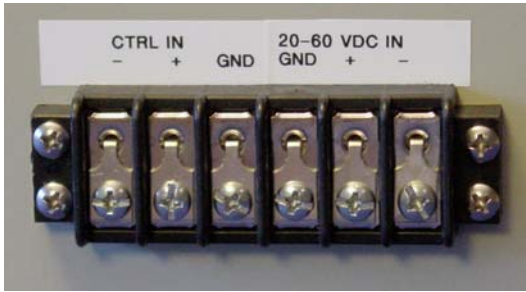
Installation Guide

Figure 9, Terminal Block, UHF Rx

Figure 10, UHF Rx, J1 Alarm Points, UHF Antenna Port

Note the indicator LED on the UHF Receiver Front Panel. The Green POWER ON LED will be ON when battery is applied.

Verification

Once the RMAS UHF transmitter and receiver are installed, connected and powered, the RMAS UHF Telemetry Receiver should acquire the radio signal and synchronize. Connect a computer terminal to the COM 1 port on the receiver's front panel to verify receive signal level and performance. Minimum 900 MHz receive signal level, RSSI is -106 dBm. Minimum 2400 MHz receive signal level, RSSI is -104 dBm Recommend RSSI -95 dBm to -60 dBm for best service.

Performance can be verified at the RMAS UHF Telemetry Transmitter by connecting a computer terminal to COM 1 serial data port on the MDS base module. This port is an RJ-45 and requires an adapter to 9-pin subminiature female. The adapter is supplied with the RMAS unit.

Figure 11, COM Adapter Cable

The COM Port provides access to the MDS Base (radio) module and to the attached expansion module. The MDS modules are interconnected by a module to module bus.

MDS Settings

Peninsula's factory configures the MDS modules to communicate properly and assigns the alarm points. All the factory settings are recorded in the Test Data Sheet supplied with the order.

To change any of the factory settings, please see the next section Admin Access.

Reasons that changes may be required:

1. Multiple RMAS or MDS links operating nearby require network address or unit ID to change.

2. To adjust the UHF transmitter power level.

3. Change the owner, location or alarm point names.

4. Module replacement.

Admin Access to GE MDS NETio --
UHF Telemetry Transmitter or Receiver

Configure a computer as a serial data terminal using HyperTerminal™ or similar.

Terminal Settings	
Data Rate	19200 bps
Data bits	8
Parity	None
Stop bits	1
Flow Control	None
Terminal Emulation	VT100
Login	admin
Password	admin

Connect to the UHF Telemetry Receiver's COM 1 port and login. The Starting Information Screen will be displayed.
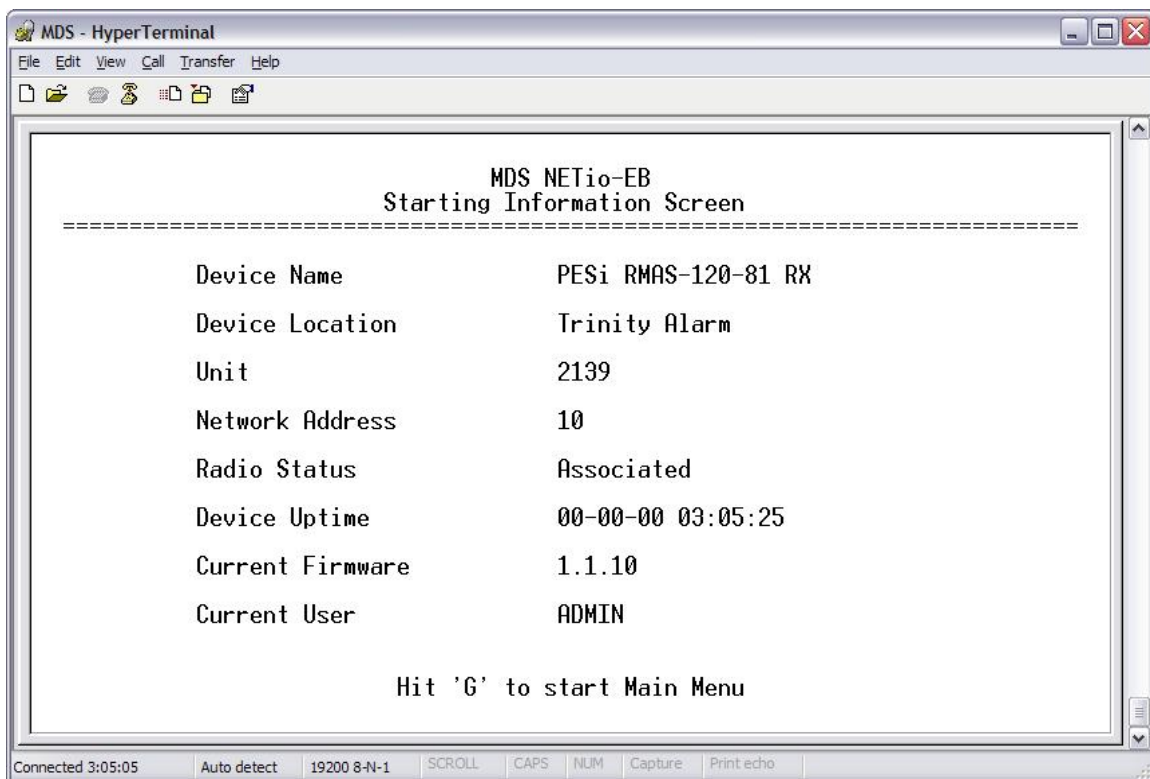
Type 'G' to go to the Main Menu.

Installation Guide
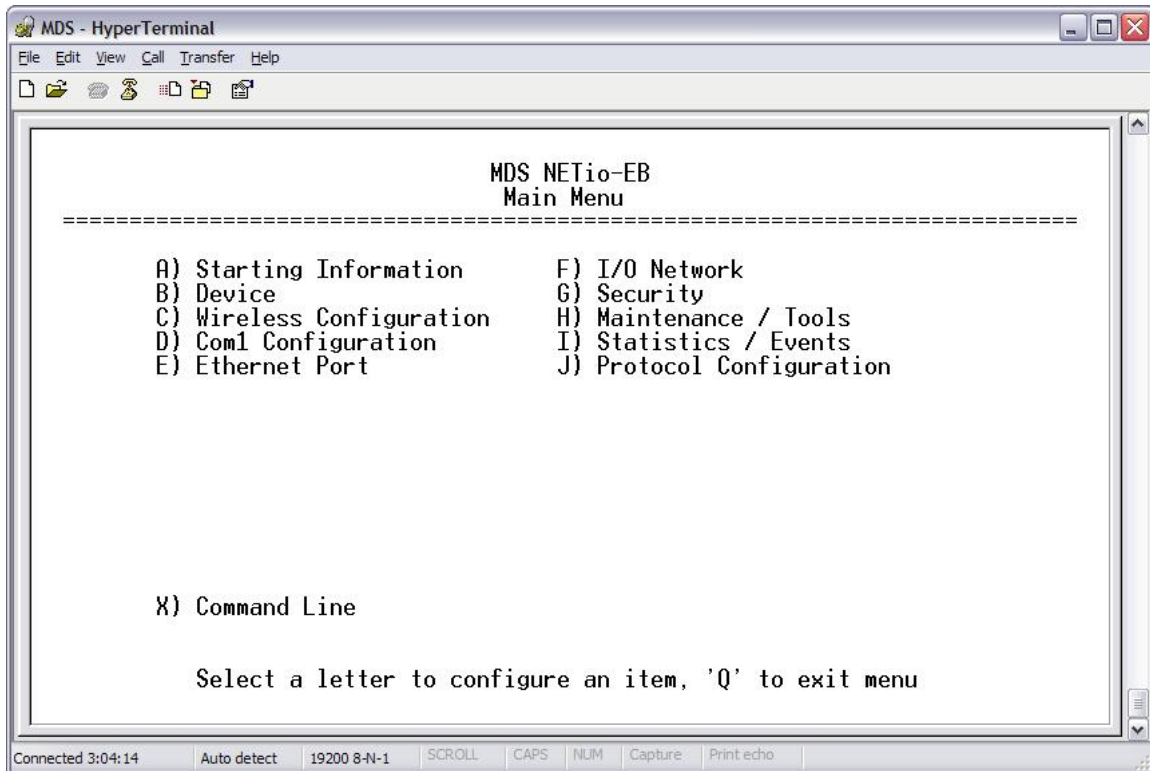
Type 'I' to go to the Statistics / Events Menu, then Type 'A' for Performance Statistics.
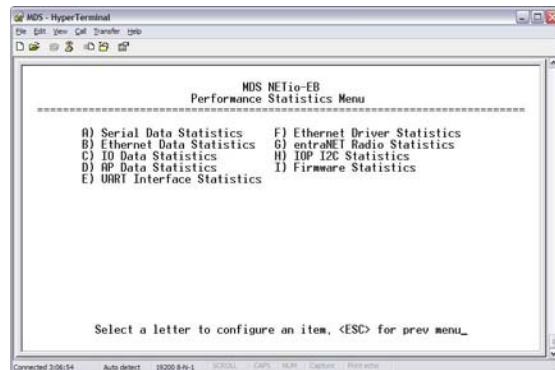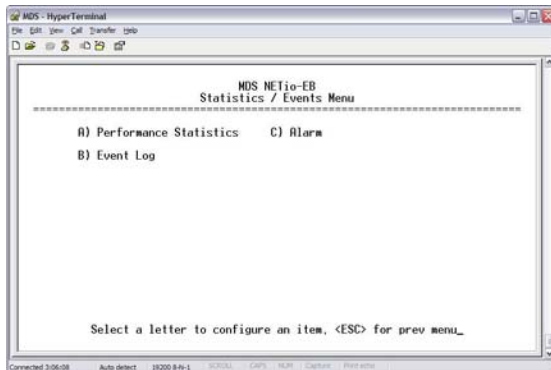
Type 'G' for entraNET Radio Statistics

Peninsula Engineering Solutions may change specifications as necessary to meet industry requirements.   © 2014 Peninsula Engineering Solutions, inc.

Peninsula Engineering Solutions, inc.   **Telephone +1 925 837-2243**
POB 1095   **Facsimile +1 925 837-2298**
Danville, California 94526, USA   Internet www.peninsulaengineering.com

Installation Guide

```
MDS - HyperTerminal
File  Edit  View  Call  Transfer  Help

                          MDS NETio-EB
                 entraNET Radio Statistics Menu
=============================================================================

   A) type        Basic Radio Interface Stats

   B) CLEAR

      Radio Sync: Synchronized with Master
      Rx sync RSSI:  -70 dBm     Average RSSI of last 8 sync packets

      RXDATA:  43976      total # of rx data packets
      TXDATA:  9770       total # of tx data packets

      Radio interface packet errors:  0
      Radio board reboots:  1




         Select a letter to configure an item, <ESC> for prev menu

Connected 3:07:38    Auto detect    19200 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Type 'A' and toggle the type of report using the SPACEBAR. Stop at RSSI/Zone Statistics.

```
MDS - HyperTerminal
File  Edit  View  Call  Transfer  Help

                          MDS NETio-EB
                 entraNET Radio Statistics Menu
=============================================================================

   A) type        RSSI/Zone Statistics

   B) CLEAR

      Rx data packet statistics per zone:
      Zone # | # of packets | last RSSI | avg RSSI  |
         1   |     5528     |    -67    |    -67    |
         2   |     5522     |    -67    |    -68    |
         3   |     5486     |    -70    |    -70    |
         4   |     5522     |    -71    |    -70    |
         5   |     5531     |    -68    |    -71    |
         6   |     5489     |    -74    |    -72    |
         7   |     5554     |    -72    |    -74    |
         8   |     5569     |    -79    |    -78    |

      Note: Data packet stats update only when data packets are received

         Select a letter to configure an item, <ESC> for prev menu

Connected 3:08:37    Auto detect    19200 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

Peninsula Engineering Solutions may change specifications as necessary to meet industry requirements.   © 2014 Peninsula Engineering Solutions, inc.

Peninsula Engineering Solutions, inc.   **Telephone +1 925 837-2243**
POB 1095   **Facsimile +1 925 837-2298**
Danville, California 94526, USA   **Internet www.peninsulaengineering.com**
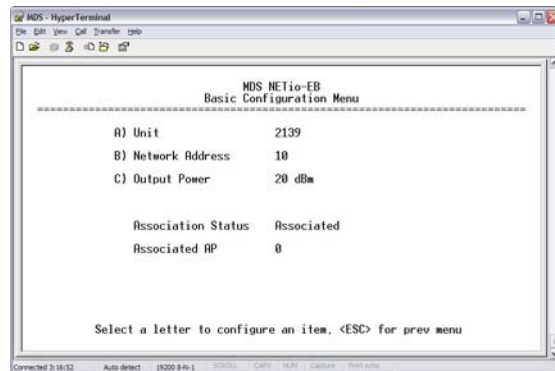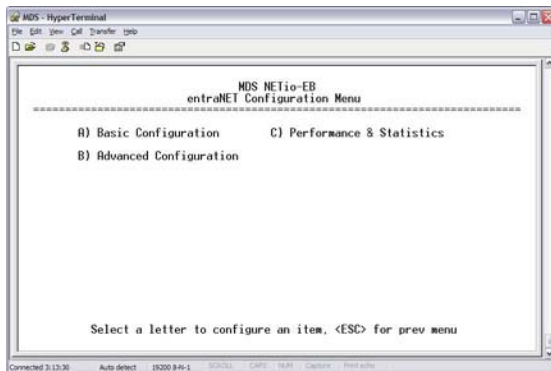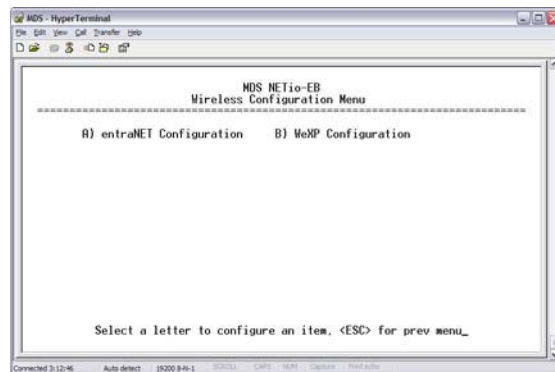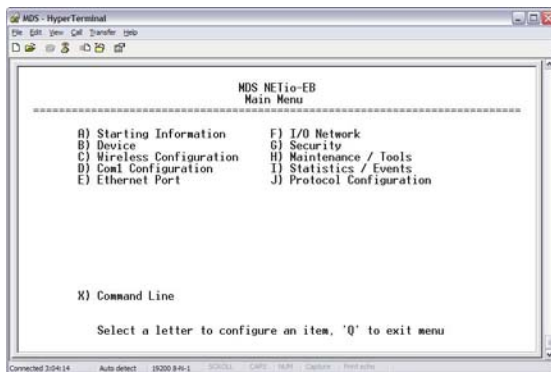
Installation Guide

Either screen can be used to read the RSSI value, the Basic Radio Interface Stats may be quicker to update.

> **Note:** this Basic Stats screen does not display real RSSI (shows -120 dBm only) at the RF Repeater (UHF Telemetry Transmitter, MDS set to "Single Root Remote") end – the RSSI/Zone Statistics screen must be used instead.

Adjust the UHF antennas for best RSSI. Target is -95 dBm or more. Threshold is -106 dBm for 10^{-06} BER.

Transmitter Setup

Start at the NETio Main Menu and type 'C' Wireless Configuration. Then type 'A' entraNET Configuration.

Type 'A' Basic Configuration, and then select the item to configure.

Selection	Item	Description
A	Unit	ID for base and associated expansion modules. Defaults to the last 4 digits of the base serial number[†]. Can be changed as necessary. Must be unique on the same network. If replacing a failed base module, recommend changing the ID to the previous unit's ID. This eliminates changes to far end point mapping.
B	Network Address	All units on the same network must use the same address. Both ends of the RMAS-120-81 UHF Telemetry Link must use the same address. Select as desired.
C	Output Power	+20 to +30 dBm in 1 dB steps.
D	Band	2400 MHz only, select A, B or C. Transmitter and Receiver must match.

Installation Guide

Hit <ESC> for the previous menu, then type 'B' for the Advanced Configuration. Select 'B' for Direct Mode.
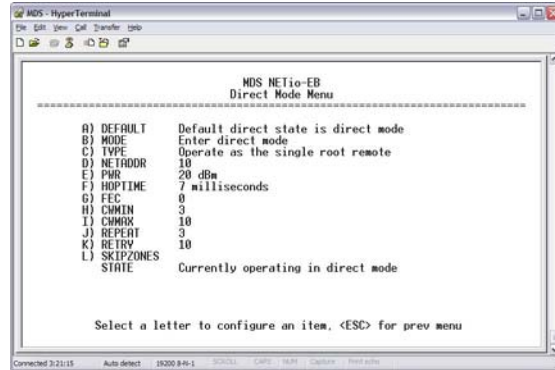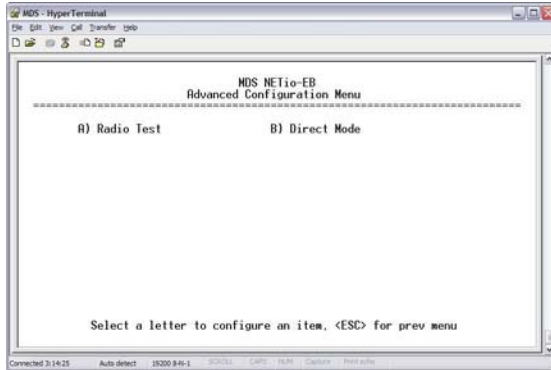
Direct Mode Menu as shown at the UHF Telemetry Transmitter end.

Selection	Item	Description – For UHF Telemetry Transmitter, RF Repeater end.
A	DEFAULT	Factory setting: Default direct state is direct mode
B	MODE	Factory setting: Enter direct mode
C	TYPE	Factory setting: Operate as the single root remote.
D	NETADDR	All units on the same network must use the same address. Both ends of the RMAS-120-81 UHF Telemetry Link must use the same address. Make same as entered on the Basic screen.
E	PWR	+20 to +30 dBm in 1 dB steps. Setting carries over from basic menu.
F	BAND	2400 MHz only, select A, B or C. Transmitter and Receiver must match.

Direct Mode Menu as shown at the UHF Telemetry Receiver end.

Peninsula Engineering Solutions may change specifications as necessary to meet industry requirements.   © 2014 Peninsula Engineering Solutions, inc.

Peninsula Engineering Solutions, inc.   **Telephone +1 925 837-2243**
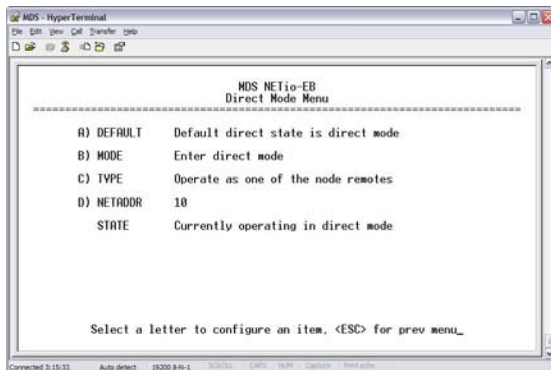**POB 1095**   **Facsimile +1 925 837-2298**
Danville, California 94526, USA   Internet www.peninsulaengineering.com

Installation Guide

Selection	Item	Description – For UHF Telemetry Receiver, MW Radio end.
A	DEFAULT	Factory setting: Default direct state is direct mode
B	MODE	Factory setting: Enter direct mode
C	TYPE	Factory setting: Operate as one of the node remotes. Important Setting!
D	NETADDR	All units on the same network must use the same address. Both ends of the RMAS-120-81 UHF Telemetry Link must use the same address. Make same as entered on the Basic screen.
E	PWR	+20 to +30 dBm in 1 dB steps. Setting carries over from basic menu.
F	BAND	2400 MHz only, select A, B or C. Transmitter and Receiver must match.

Peninsula Engineering Solutions may change specifications as necessary to meet industry requirements.   © 2014 Peninsula Engineering Solutions, inc.

Peninsula Engineering Solutions, inc.   **Telephone +1 925 837-2243**
POB 1095   **Facsimile +1 925 837-2298**
Danville, California 94526, USA   **Internet www.peninsulaengineering.com**
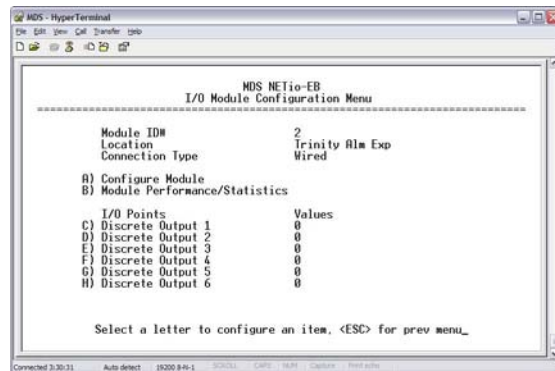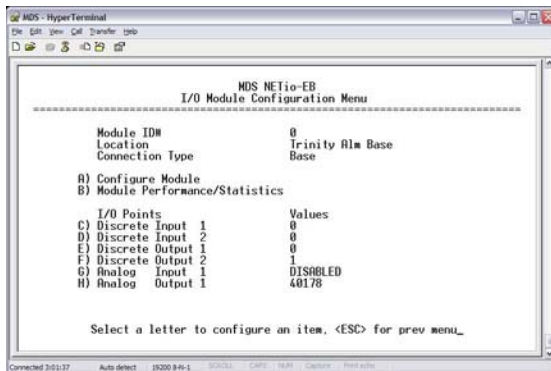
Installation Guide

Alarm Point I/O Settings

Start at the NETio Main Menu and type 'F' I/O Network.
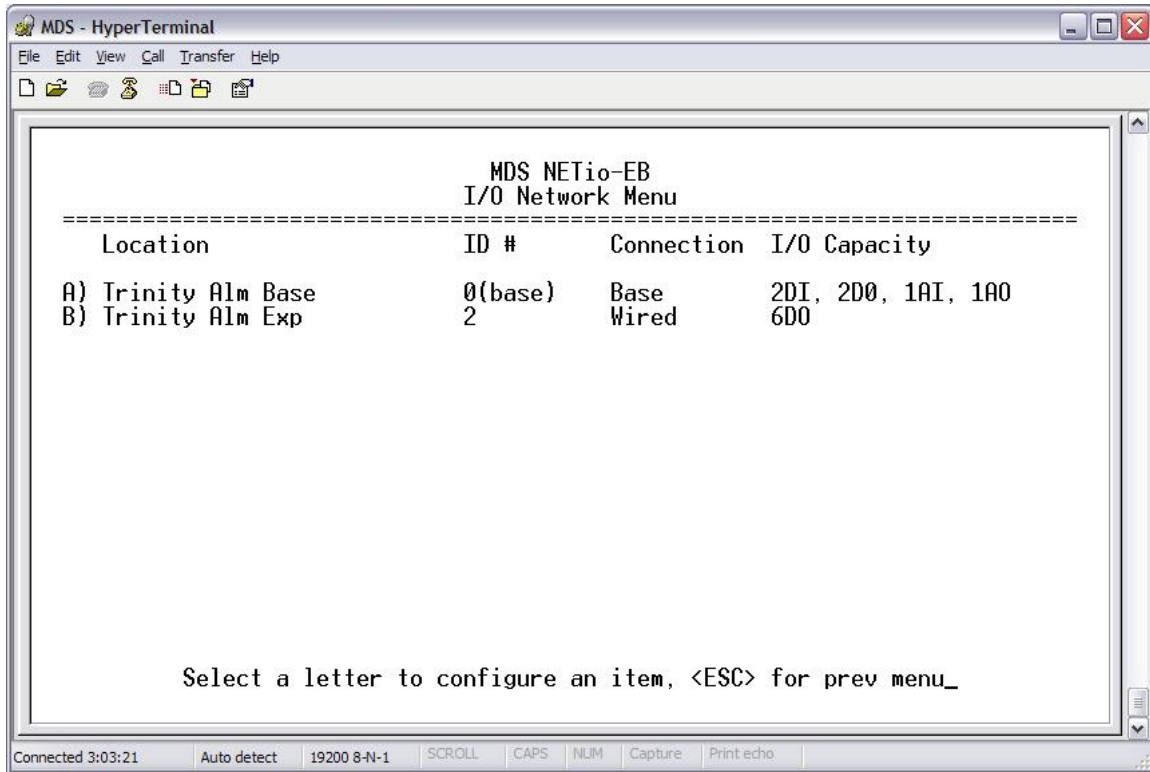
Select 'A' to view or modify A1, the Base (radio) module, ID=0.
Select 'B' to view or modify A2, the Expansion module, ID=2.

I/O screens as shown at the UHF Telemetry Receiver end.

At the Receiver location, Discrete Outputs and Analog Output have been mapped to the coordinated Transmitter location. Recommend using the factory assignments.

Installation Guide

Factory Alarm Point Assignments

Alarm Point	UHF Tx	UHF Rx	J1 Pins	Detail	Output Type
Battery A Low	A1 DI-1	A1 DO-1	01+ 02-	0=Normal, 1=Alarm, Battery A < 11V	FET Relay, dry, isolated 36 VDC open circuit - withstand. 2 A load current per output. Polarity sensitive
Battery B Low	A1 DI-2	A1 DO-2	03+ 04-	0=Normal, 1=Alarm, Battery B < 11V	
RF Pwr Low F1	A2 DI-1	A2 DO-1	05+ 06-	0=Normal, 1=Alarm, Frequency F1 > 5 dB drop in Tx power	
RF Pwr Low F2	A2 DI-2	A2 DO-2	07+ 08-	0=Normal, 1=Alarm, Frequency F2 > 5 dB drop in Tx power	
Amplifier A1	A2 DI-3	A2 DO-3	13+ 14-	0=Normal, 1=Alarm, Amplifier A1 (F1) Current too high or too low	
Amplifier A2	A2 DI-4	A2 DO-4	15+ 16-	0=Normal, 1=Alarm, Amplifier A2 (F2) Current too high or too low	
Door	A2 DI-5	A2 DO-5	31+ 32-	0=Normal, 1=Alarm, Repeater enclosure door open	
Waveguide	A2 DI-6	A2 DO-6	33+ 34-	0=Normal, 1=Alarm, Waveguide pressure low (may be reassigned in not used)	
Temperature V	A1 AI-1	A1 AO-1	35+ 36- 37Gnd	0 = -40C, 65535 = +60C, linear scale 0 = 4mA, 65535 = 20mA	4-20 mA current loop. 24 V internal power supply.

A1 = Base (radio) Module, ID 0.   A2 = Expansion Module, ID 2.

Temperature sensor table

Temperature		Sensor Voltage	MDS 16 bit Coding	Analog O/P 4-20 mA
C	F			
-40	-40	0.00	0	4.00
-35	-31	0.25	3,277	4.80
-30	-22	0.50	6,554	5.60
-25	-13	0.75	9,830	6.40
-20	-4	1.00	13,107	7.20
-15	5	1.25	16,384	8.00
-10	14	1.50	19,661	8.80
-5	23	1.75	22,937	9.60
0	32	2.00	26,214	10.40
5	41	2.25	29,491	11.20
10	50	2.50	32,768	12.00
15	59	2.75	36,044	12.80
20	68	3.00	39,321	13.60
25	77	3.25	42,598	14.40
30	86	3.50	45,875	15.20
35	95	3.75	49,151	16.00
40	104	4.00	52,428	16.80
45	113	4.25	55,705	17.60
50	122	4.50	58,982	18.40
55	131	4.75	62,258	19.20
60	140	5.00	65,535	20.00

Installation Guide

Date and Time Setting

Once all other settings are complete and the radio link is operational, set the Date and Time using the Maintenance/Tools Menu.

Note: The date and time settings are lost on power down and must be re-entered on power up. Date and time are used for log entry purposes.
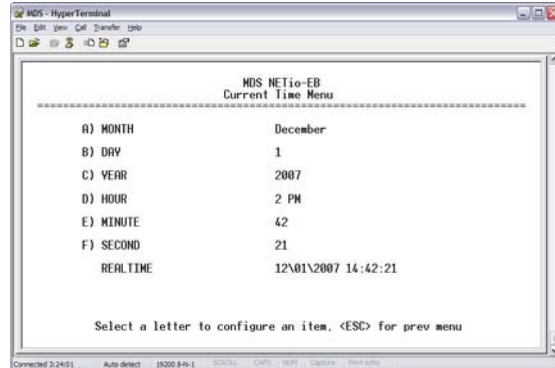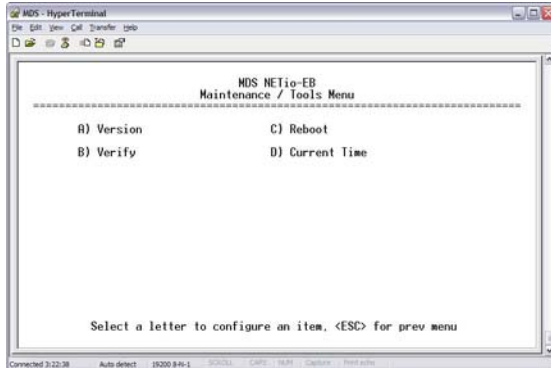
Control Channel

The control channel runs from the UHF Telemetry Receiver to the UHF Telemetry Transmitter. To activate the control, apply +5 to +36 V across the CTRL IN (+, -) inputs located on the rear of the receiver unit at the terminal strip. These inputs are isolated from ground and power.

The control channel is deactivated when less than 5 V or open circuit is present at these inputs.

When activated, the control channel will cause a FET relay to close at the UHF Telemetry Transmitter (RF Repeater end). This output is ground referenced. The FET relay withstands +36 VDC when open/deactivated and will conduct up to 2 Amps of load current when closed/activated. The output terminal is located on the terminal block below the MDS modules, CTRL OUT with white wire attached.

Installation Guide

Trouble Shooting

Should there be any difficulty in establishing a radio link, consider the following items:

1. Are all the units properly installed and wired?
2. Is DC power applied and are the power indicators illuminated?
3. Are the UHF antennas installed, aligned toward the distant end?
4. Are the UHF antenna polarizations the same at both ends?
5. Are the coax feedlines installed correctly? Check the return loss or continuity.
   a. Return Loss should be 14 dB or greater. (VSWR 1.5:1 or less)
6. RSSI should be greater than -106/-104 dBm and best between -95 dBm and -60 dBm.
7. Are the UHF equipments properly coordinated? Units are configured to only communicate with the intended coordinate end.
8. Have the MDS settings been changed? If so, confirm the correct settings.
   a. Network Address and Direct Mode are important.
      i. Set both ends the same.
   b. The repeater end should be set as "Root" and receiver end set as "Node".
      i. If both ends are set the same, they will not communicate.

[†] ID Entry field will not accept leading zeros (0). You may choose to use fewer than four digits to match the module serial number. This applies to both RMAS Transmitter and Receiver units.
See examples below:

Serial Number last four digits	Unit ID entered
1234	1234
0234	234
0034	34
0004	4

Peninsula Engineering Solutions may change specifications as necessary to meet industry requirements.   © 2014 Peninsula Engineering Solutions, inc.

Peninsula Engineering Solutions, inc.   **Telephone +1 925 837-2243**
POB 1095   **Facsimile +1 925 837-2298**
Danville, California 94526, USA   **Internet www.peninsulaengineering.com**